

FIRST NZ IMPLANT WITH FIRST IMPLANT

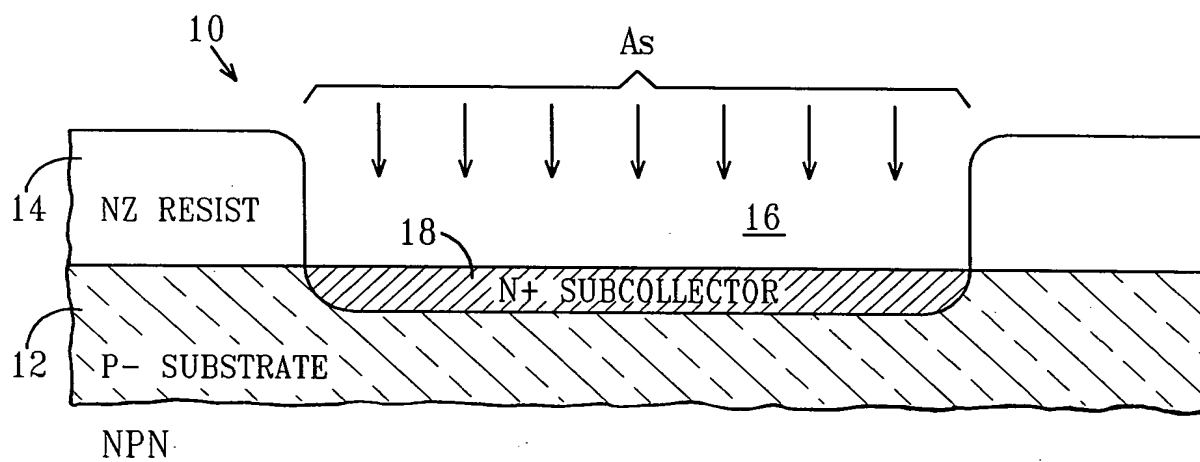


FIG.1

NZ MASK: IMPLANT SUBCOLLECTOR  
NZ2 SECOND IMPLANT

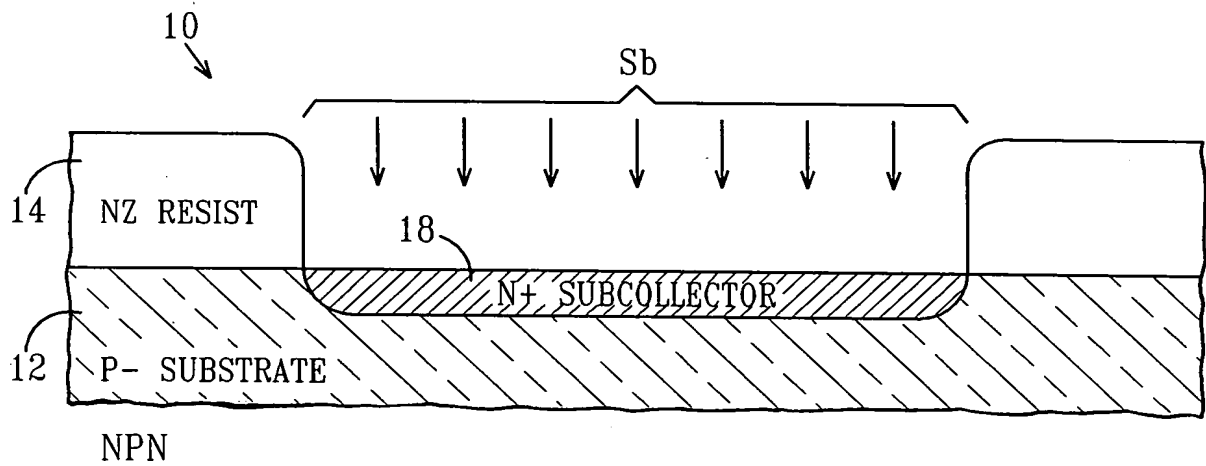


FIG. 2

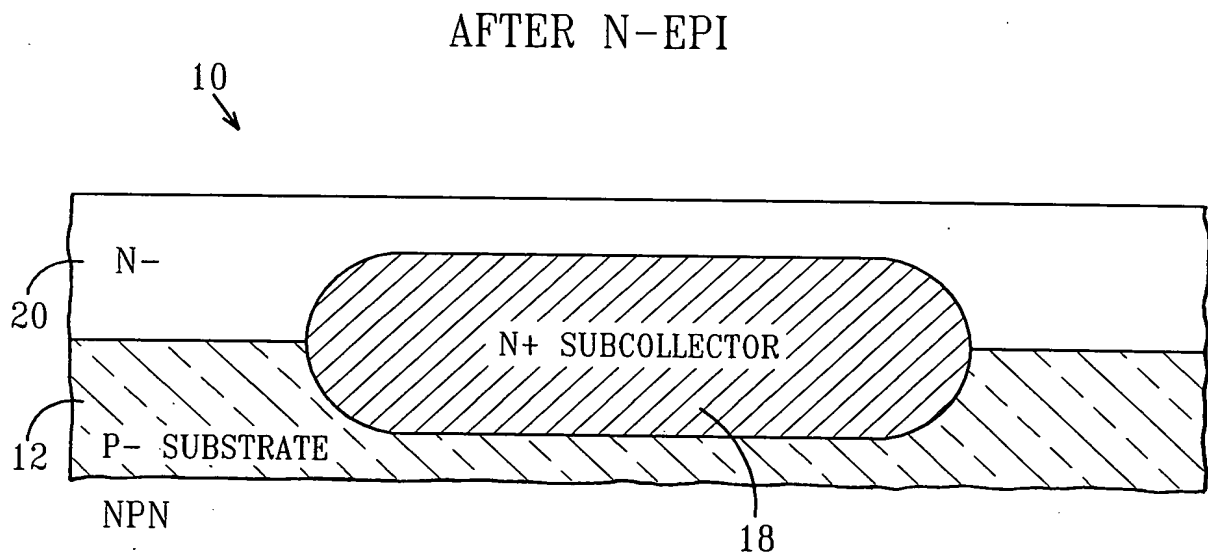


FIG. 3

DT MASK: ETCH DEEP TRENCH; IMPLANT CHANNEL STOP; FILL DEEP TRENCH

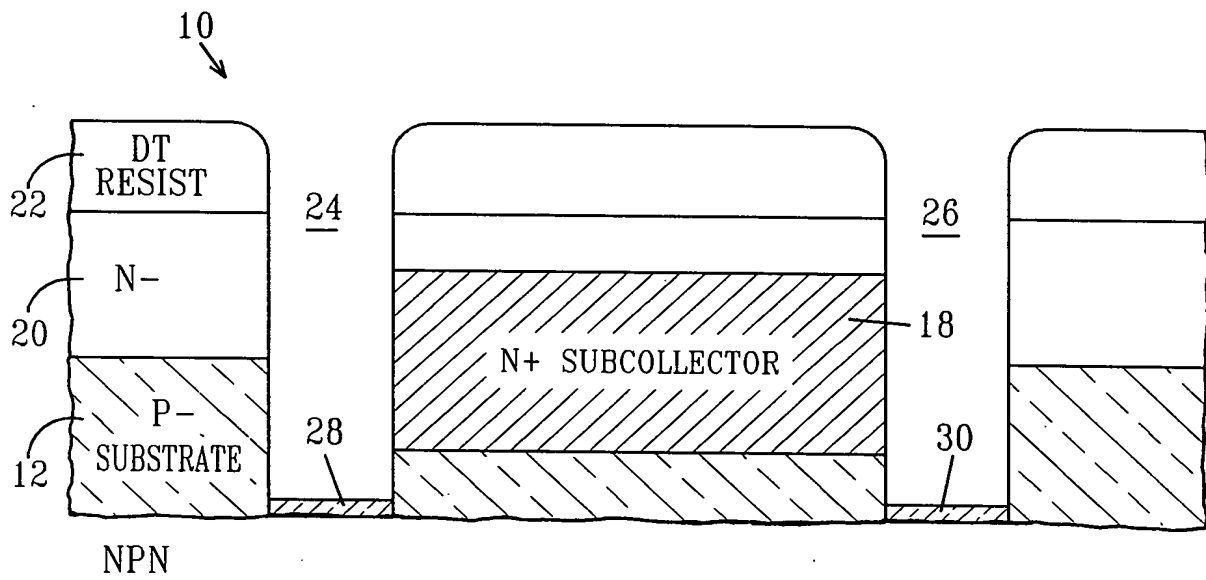


FIG. 4

RX MASK: ETCH SHALLOW TRENCH

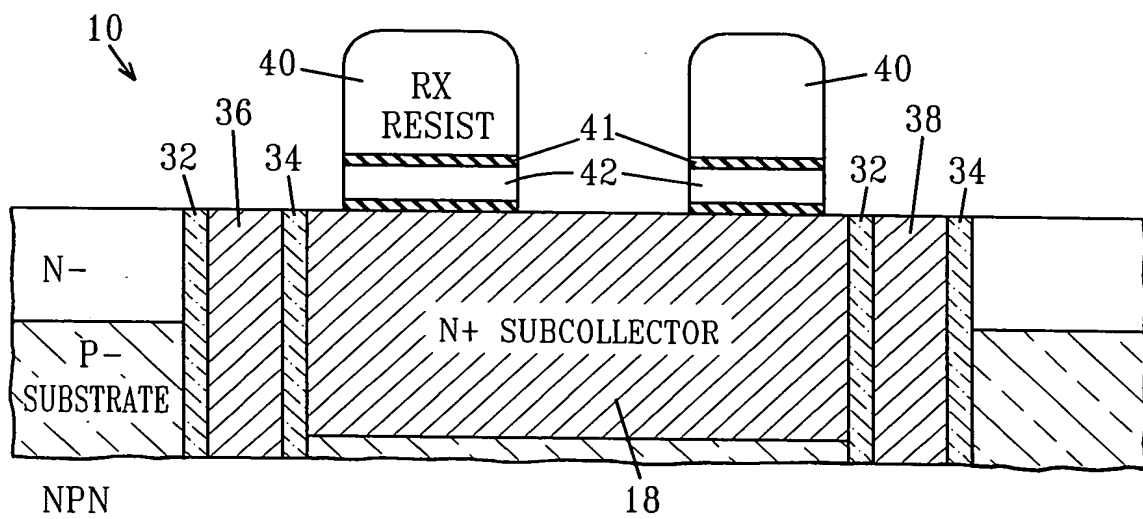


FIG. 5

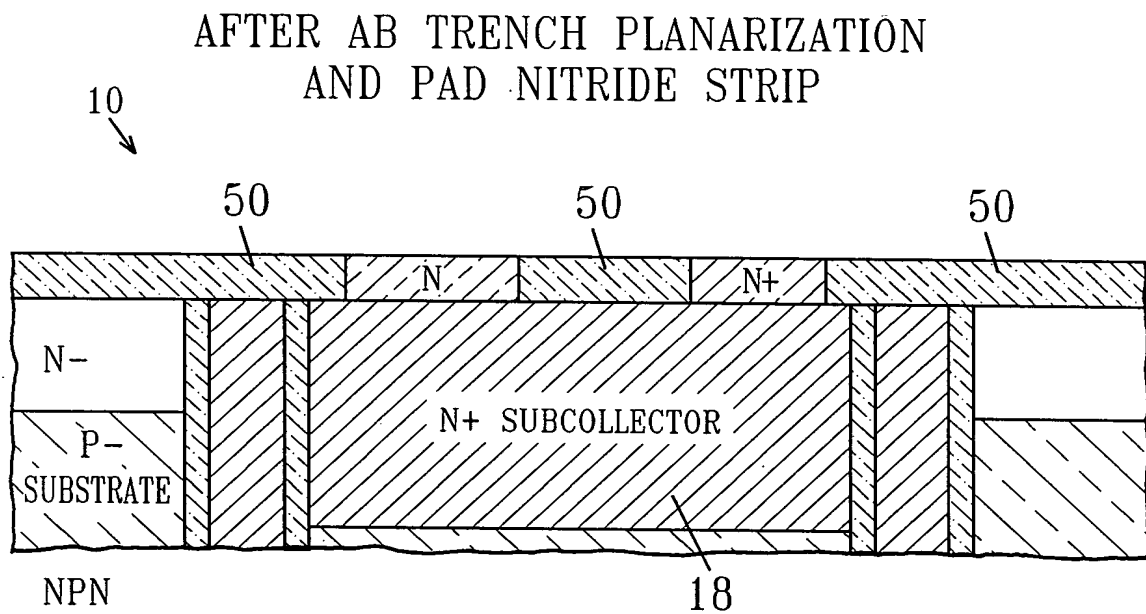


FIG. 6

BX MASK: ETCH OX/POLY/OX; IMPLANT DEEP PEDESTAL;  
ETCH NITRIDE/OX

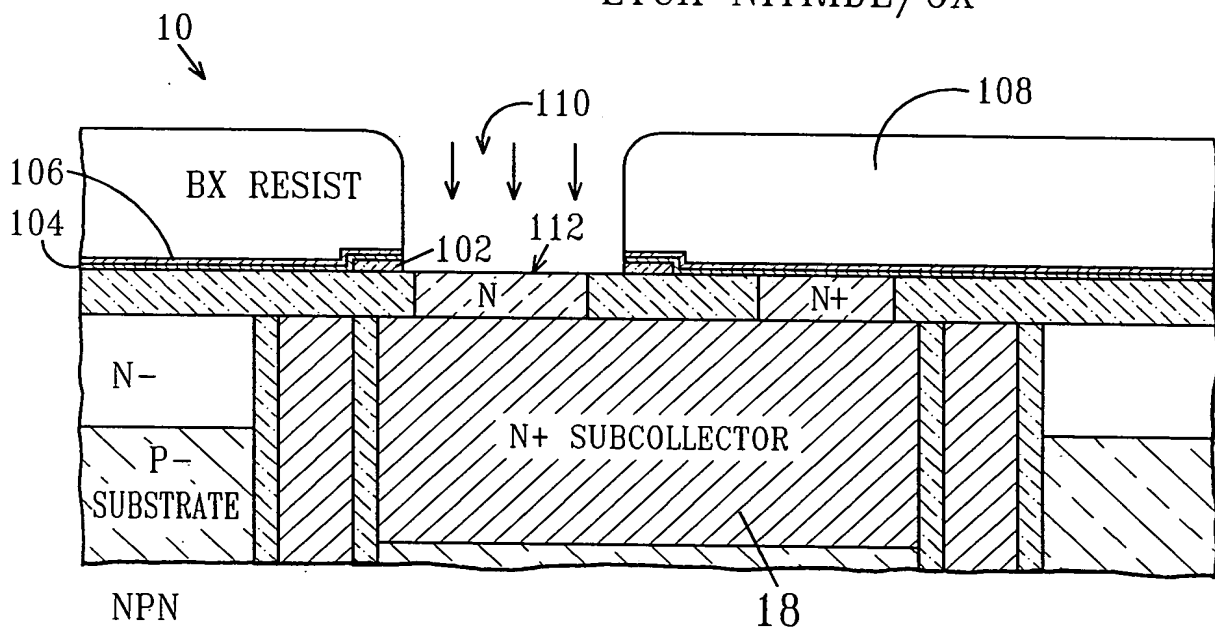


FIG. 7

AFTER LTE EPI AND BASE FILMS DEPOSITION

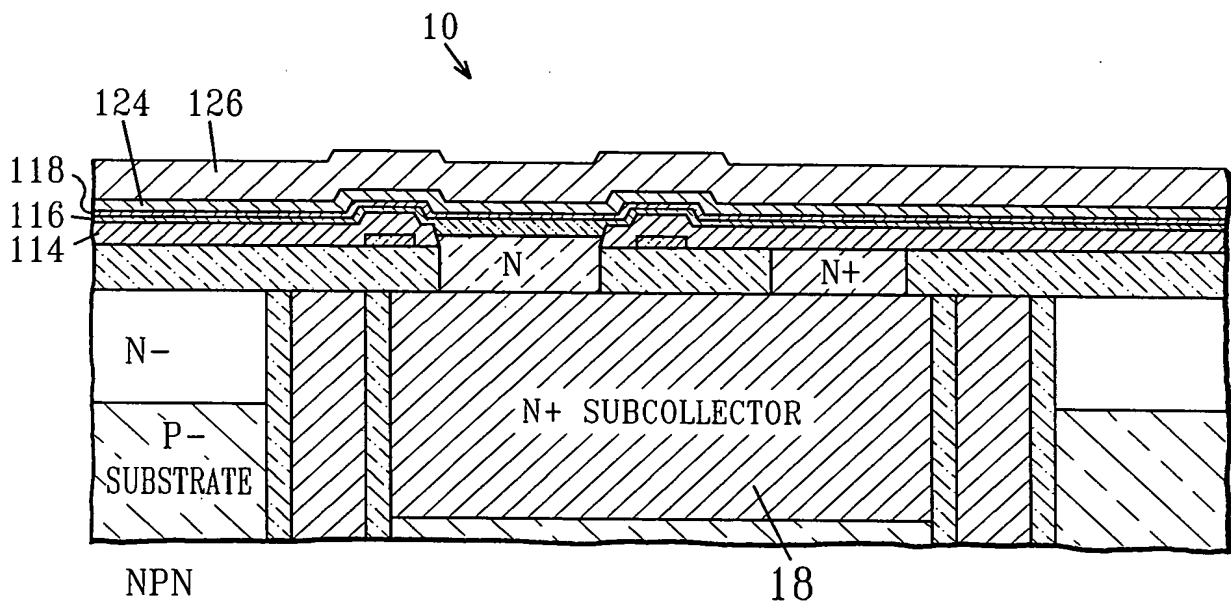


FIG. 8



EN MASK: DEFINE EMITTER AND EXTRINSIC BASE

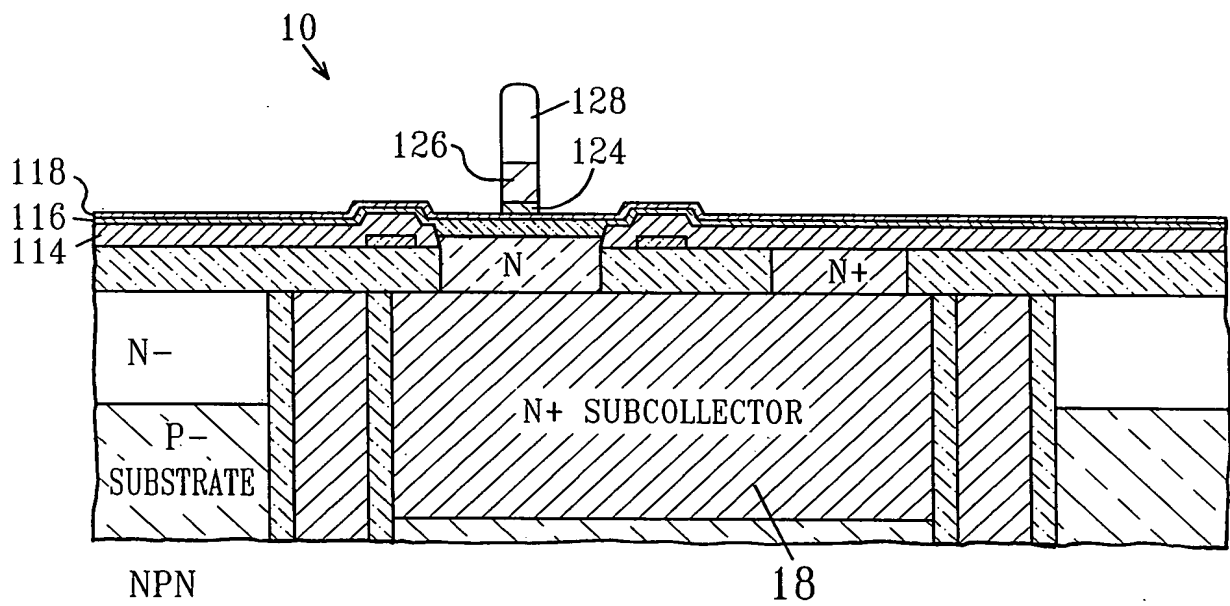


FIG. 9

# EXTRINSIC BASE IMPLANT

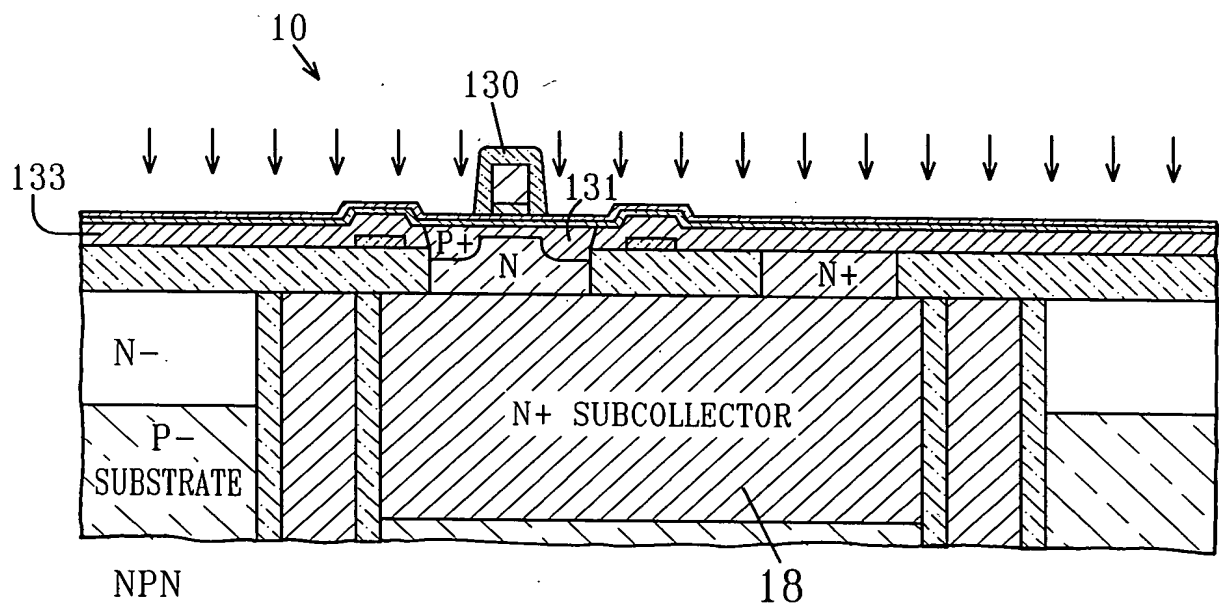


FIG.10

# ETCH EMITTER OPENING

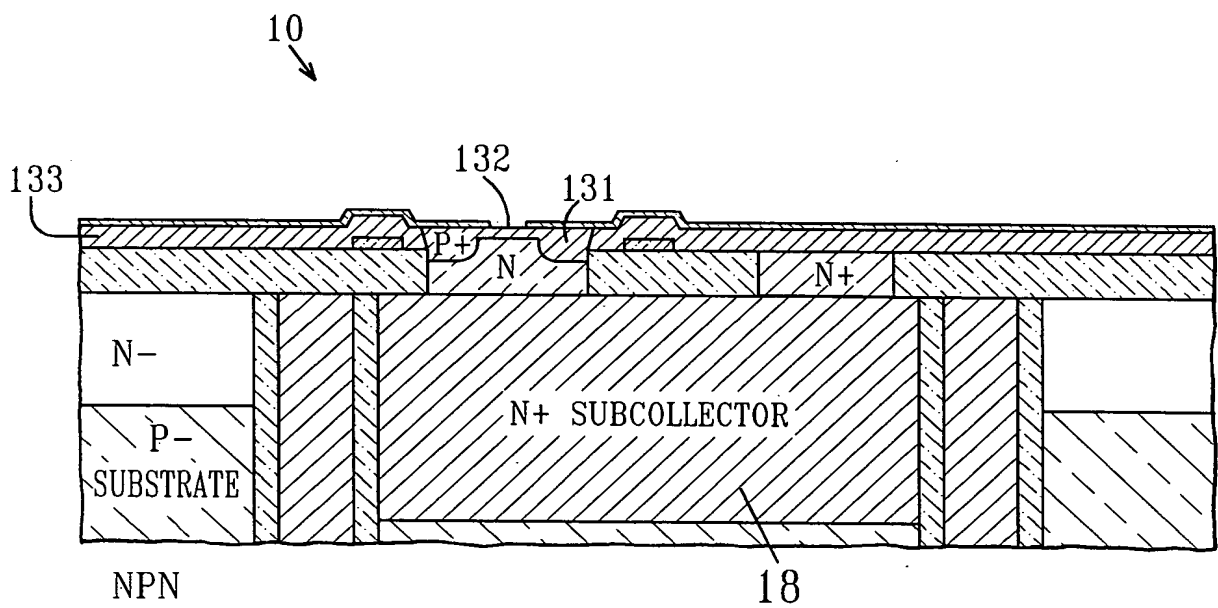


FIG. 11

N2 MASK: IMPLANT NPN PEDESTAL

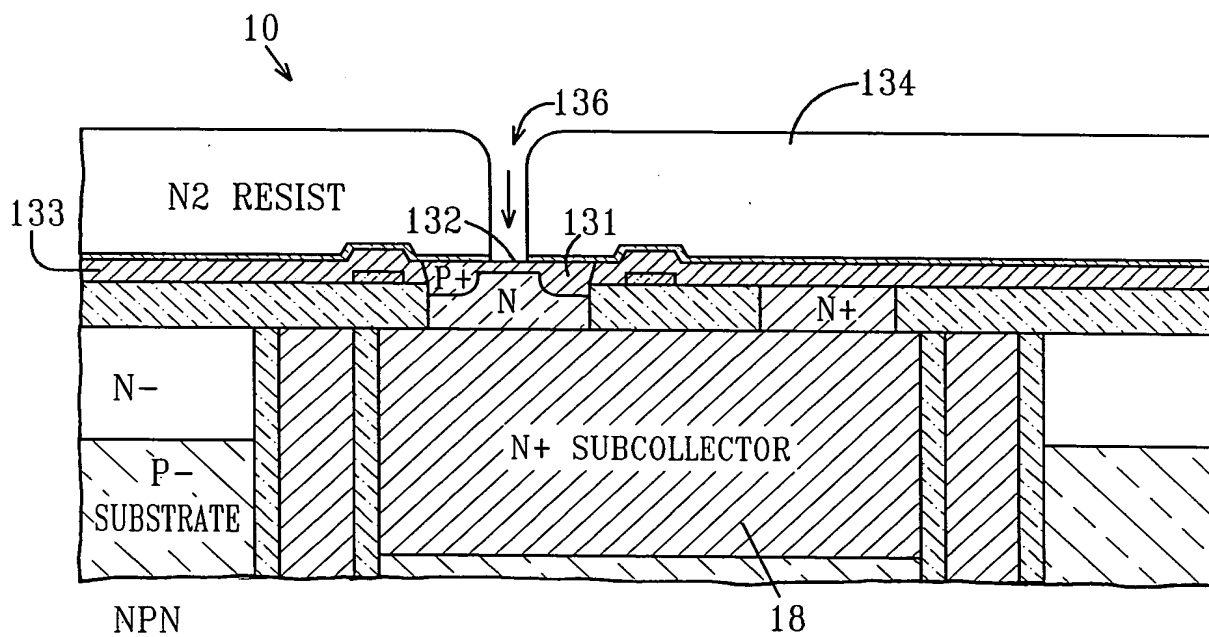


FIG.12

NP MASK: ETCH NPN EMITTER POLY  
AND EMITTER FILMS

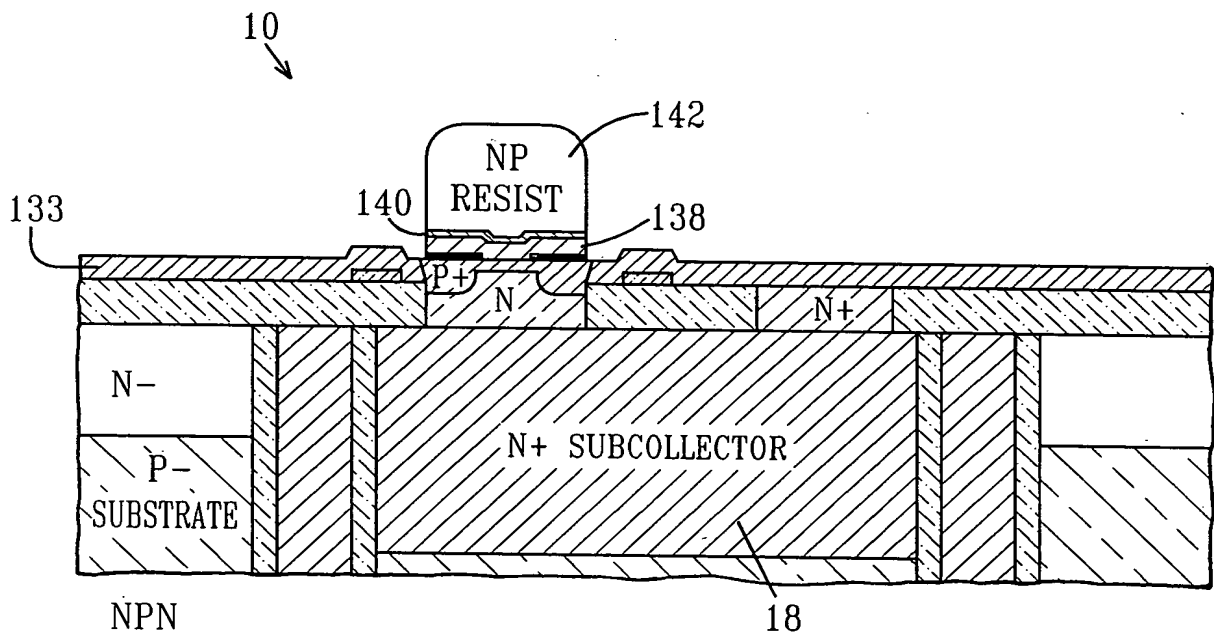


FIG. 13

PB MASK: ETCH NPN BASE POLY  
AND FET PROTECT OXIDE

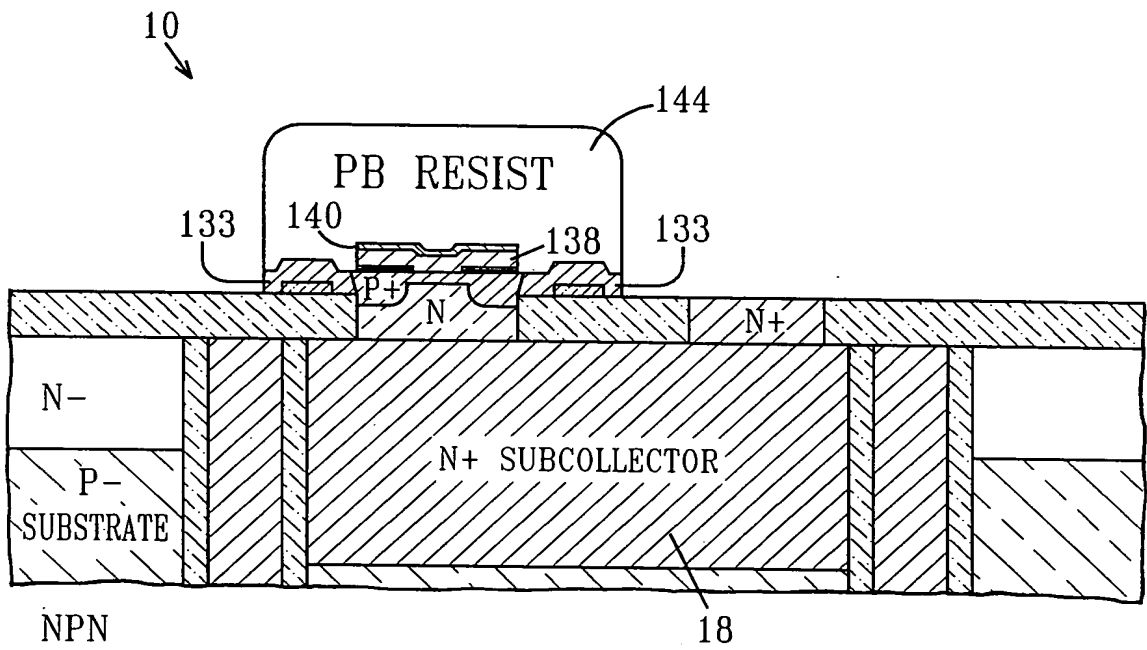


FIG. 14

OP MASK: FORM NPN SPACER  
AND RESISTOR  $\text{TiSi}_x$  BLOCK

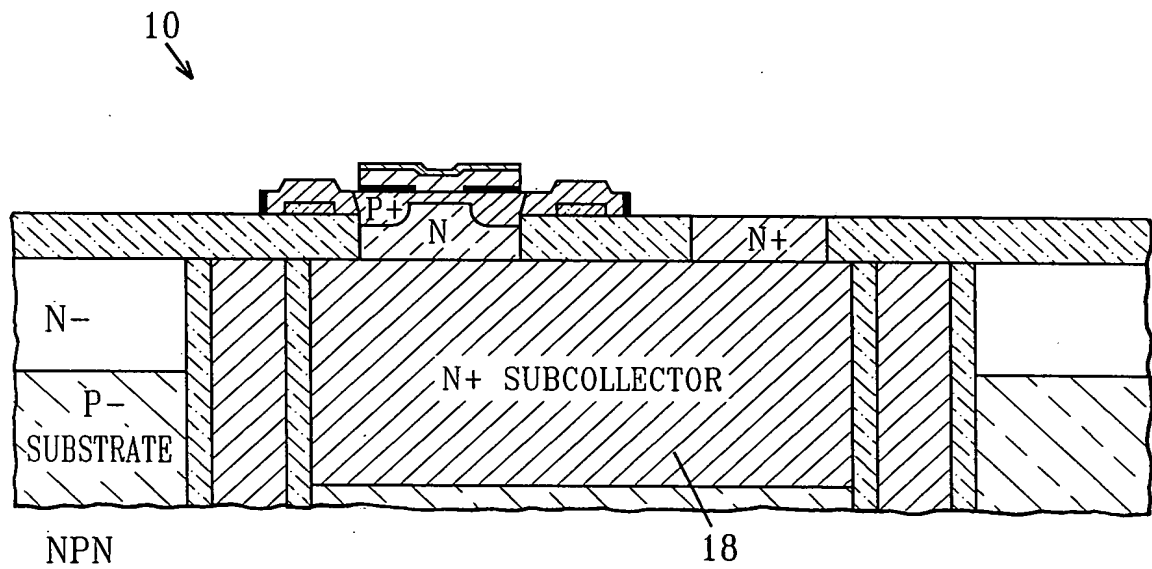


FIG.15

AFTER  $\text{TiSi}_x$  FORMATION

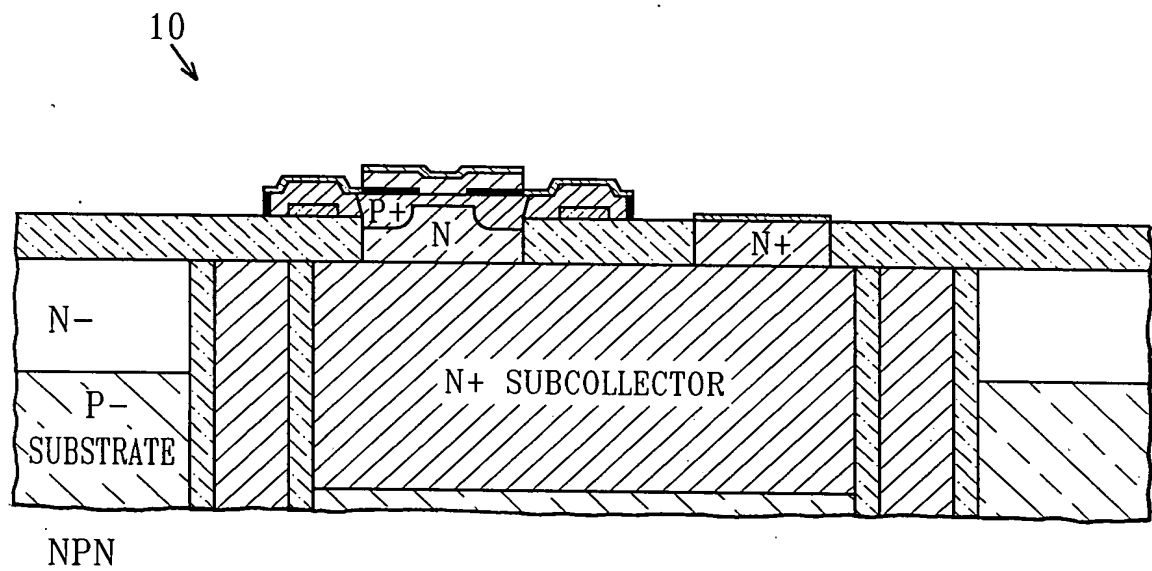


FIG. 16



FIG. 17

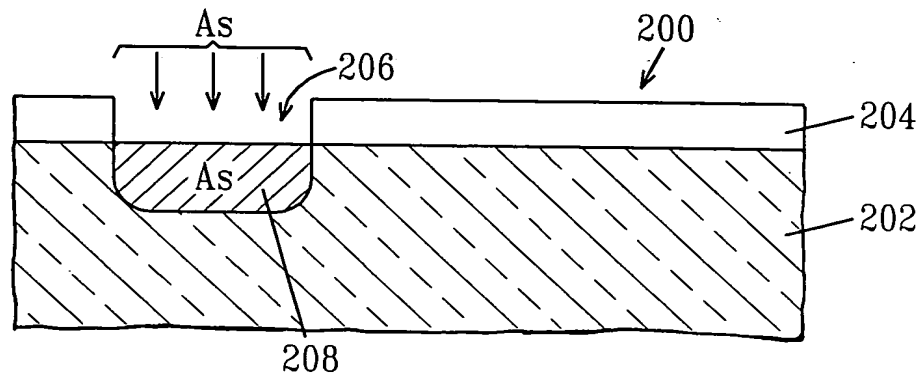


FIG. 18

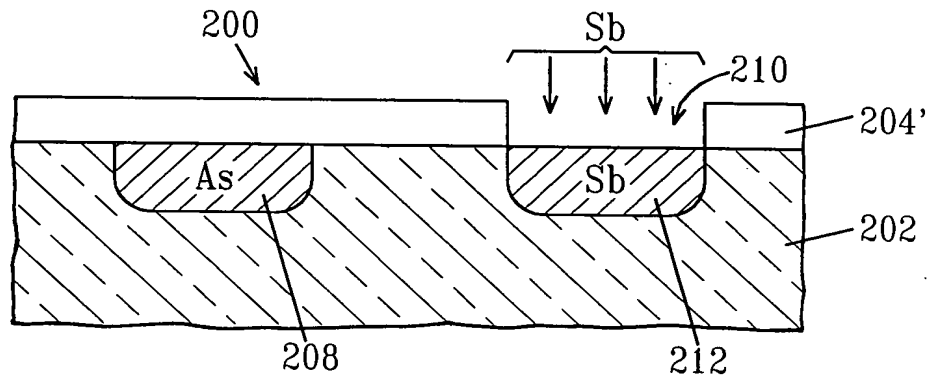


FIG. 19

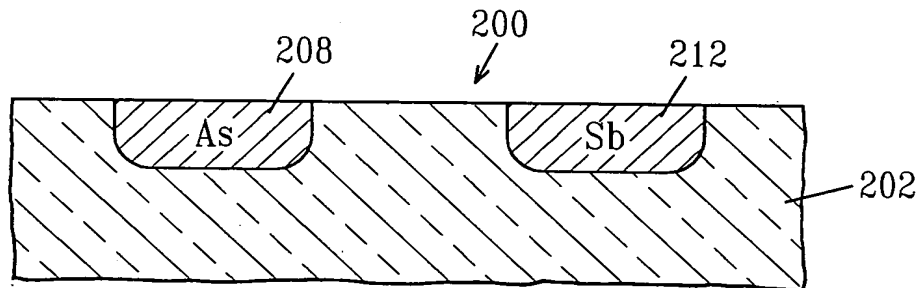
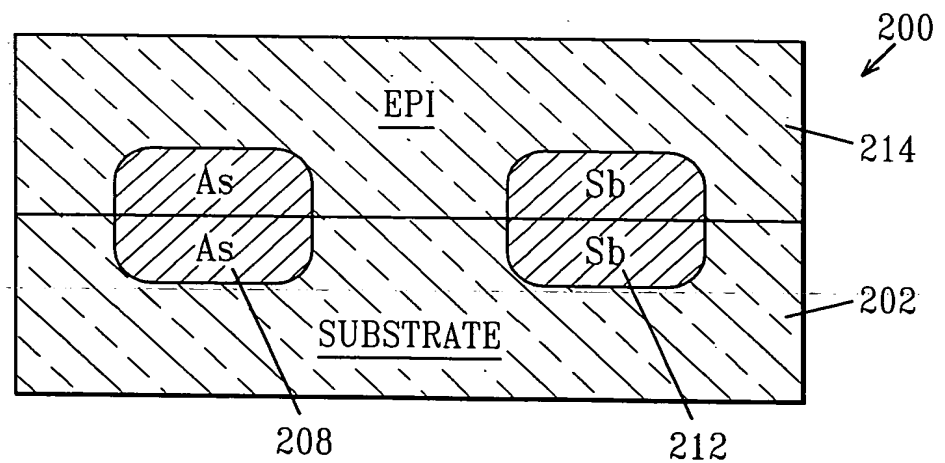


FIG. 20



# SiGe HBT TRANSISTOR

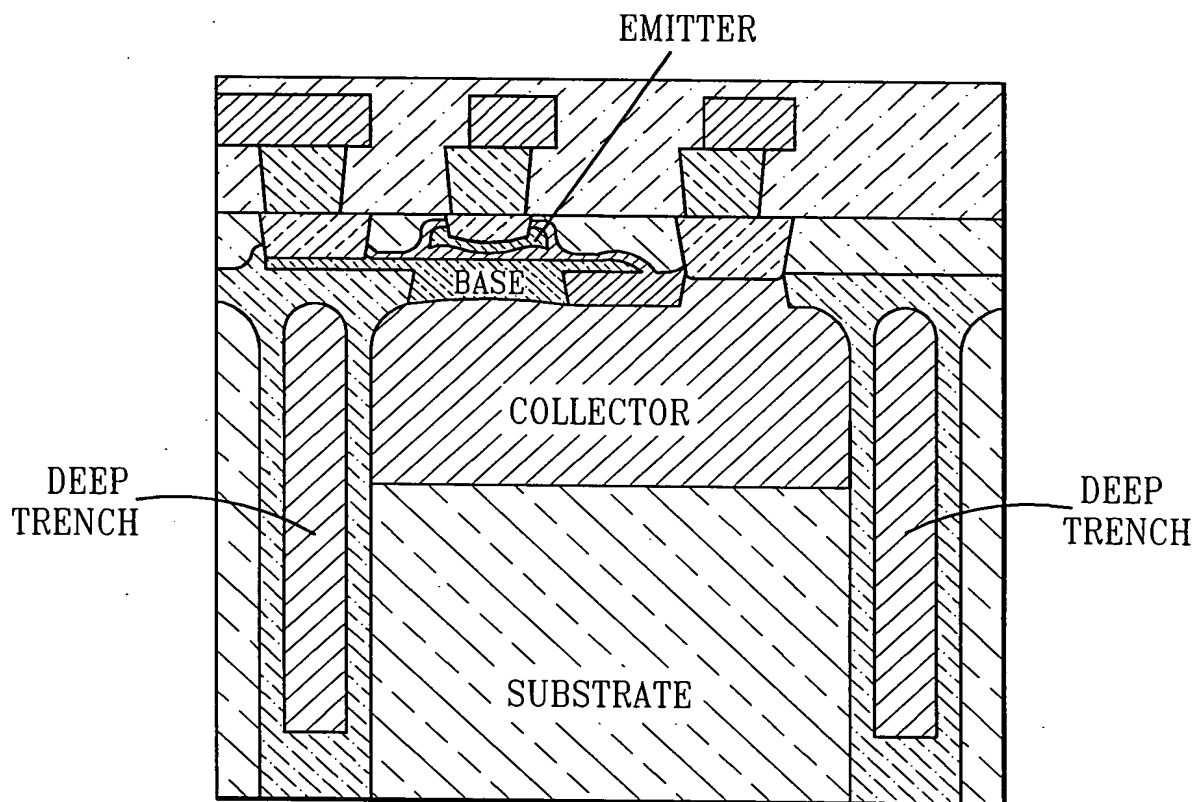


FIG. 21

Base-Collector ESD Robustness of SiGe HBT for  
Different Epitaxial Subcollector Doses.

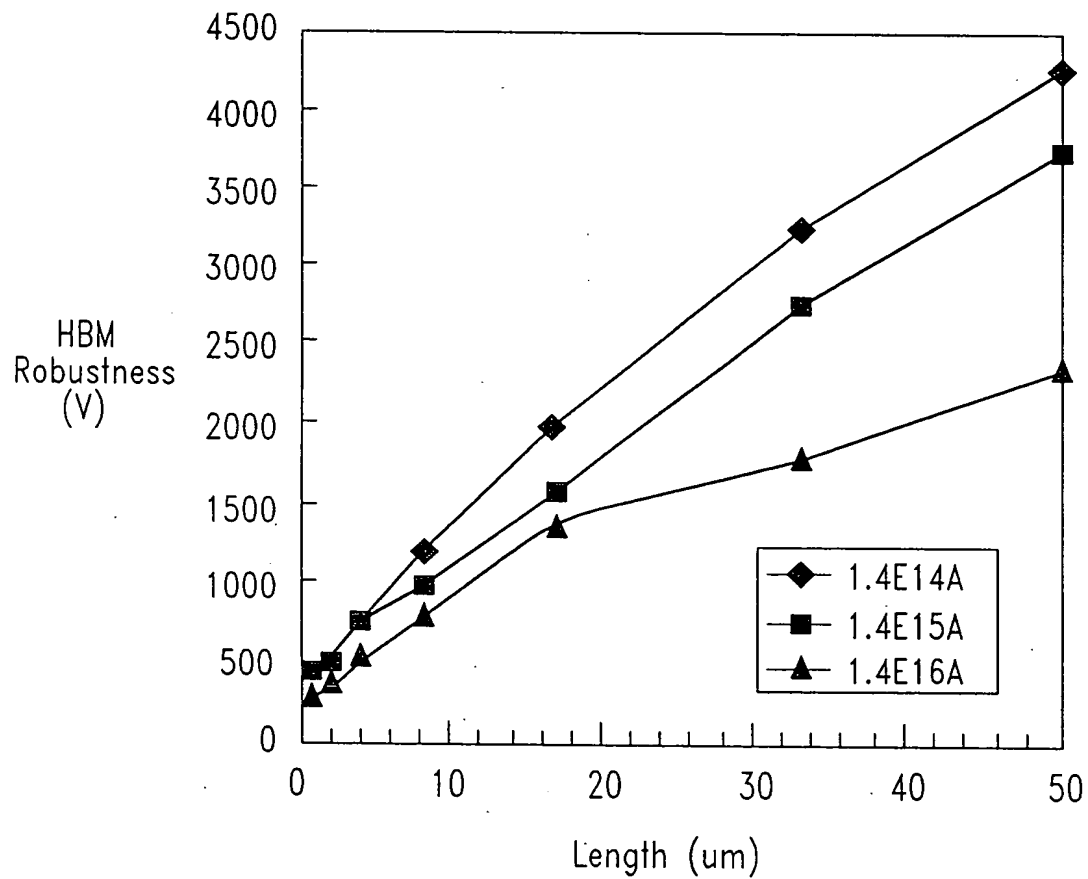


FIG. 22

### ESD Robustness of a SiGe HBT for Epitaxial As and Sb Subcollectors

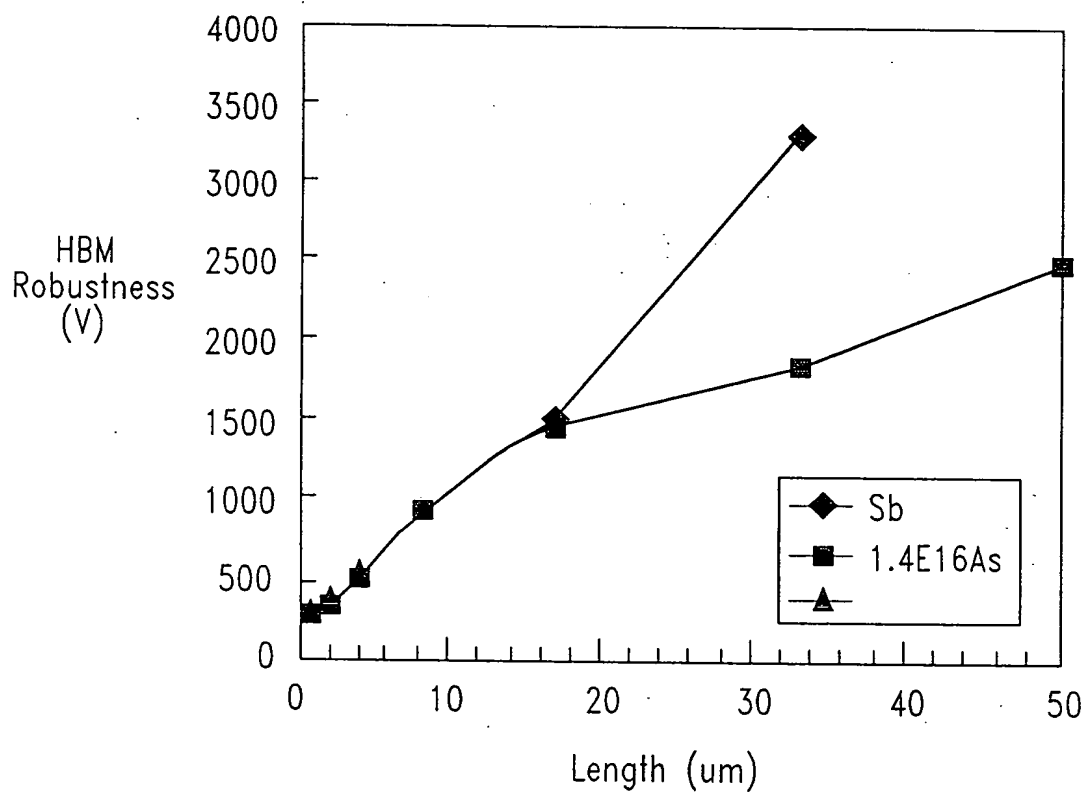


FIG. 23

ESD Results of Sb SiGe Varactor Structure vs As SiGe Varactor (No pedestal)

Varactor Width (um)	Varactor Length (1 um)	POR As Subcollector HBM Results PULSE	Sb Subcollector HBM Results PULSE
0.32	1.0	270-300V	400-700V
0.32	2.1	360-390V	500-600V
0.32	4.2	510-570V	800V
0.32	8.4	540-900V	1100-1300V
0.32	16.8	570-1560V	1300-2100V
0.32	33	540-570V	3500-3700V
0.32	50	2610-2670V	3700-4300V
0.44	50	2700-2800V	4000-4200V

FIG. 24

ESD Results of Sb SiGe Varactor Structure vs As SiGe Varactor (No pedestal)

Varactor Width ( $\mu\text{m}$ )	Varactor Length (1 $\mu\text{m}$ )	POR As Subcollector HBM Results	Sb Subcollector HBM Results
0.32	1.0	120-150V	300-800V
0.32	2.1	120V	300-600V
0.32	4.2	120-150V	300V
0.32	8.4	150V	200-300V
0.32	16.8	150V	300-700V
0.32	33	150V	300-900V
0.32	50	150V	400-1400V
0.44	50	150V	400-2100V

FIG. 25